Metabolic Networks Classification: explainability by multidisciplinary integration

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Graphs are powerful structures able to capture topological and semantic information from data, hence suitable for modelling a plethora of real-world (complex) systems. Here we tested such an approach on a large set of organisms (5299) for which metabolic networks are known, allowing for both a perfect mirroring of the underlying taxonomy and the identification of most discriminant metabolic reactions and pathways. The widespread diffusion of graph (network) structures in biology makes the proposed pattern recognition approach potentially very useful in many different fields of application. More specifically, the possibility to have a reliable metric to compare different metabolic systems is instrumental in emerging fields like microbiome analysis and, more in general, for proposing metabolic networks as a universal phenotype spanning the entire tree of life and in direct contact with environmental cue